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Flight Analysis Branch

MISSION PLANNING AND ANALYSIS DIVISION

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

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PROJECT APOLLO

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By Samuel R. Newman and Dallas G. Ives
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SUMMARY

The purpose of this internal note is to present prelaunch measured wind data and predicted command module horizontal velocities for land landings (in the event of a mode I abort) for the Apollo 9 mission. Because land landing in the event of a near-pad abort is highly probable and because the horizontal landing velocity is limited to insure command module (CM) structural integrity, the data are required by the MSC flight director during the prelaunch activities.

The peak horizontal landing velocity calculated for the Apollo 9 mission was 33 fps, which is below the spacecraft landing restriction of 54 fps. Therefore, it was not necessary to delay the Apollo 9 launch for this restriction.

INTRODUCTION

The design capability of the Apollo spacecraft indicates that, in the event of a mode I launch escape vehicle (LEV) abort, a land landing is acceptable provided that the horizontal velocity of the CM at landing does not exceed 54 fps. A requirement has been established to provide real-time data for the spacecraft horizontal landing velocity during the prelaunch countdown. The procedure for calculation of the horizontal velocities is as follows: obtain peak wind velocities in knots from five specified altitudes on the NASA meteorological tower at KSC, determine a value for the wind profile slope (P), determine the horizontal landing velocity from the wind profile slope and from the peak wind velocity at a referenced altitude. A more detailed explanation of the procedure can be found in reference 1. The procedure was used during the prelaunch countdown for the Apollo 9 mission, and the data were made available to the MSC flight director and to the KSC launch director to aid them in their GO/NO-GO criteria.

WIND PROFILE MEASUREMENT

The wind profile measurements obtained prior to lift-off from the 500-foot NASA meteorological tower, KSC, were recorded on March 3, 1969 at t minus 9.75 hours, at t minus 7.5 hours, at t minus 4.25 hours, at t minus 1.75 hours, and at t minus 0.75 hour. The peak winds were recorded for altitudes of 162 feet, 200 feet, 300 feet, 400 feet, and 500 feet.

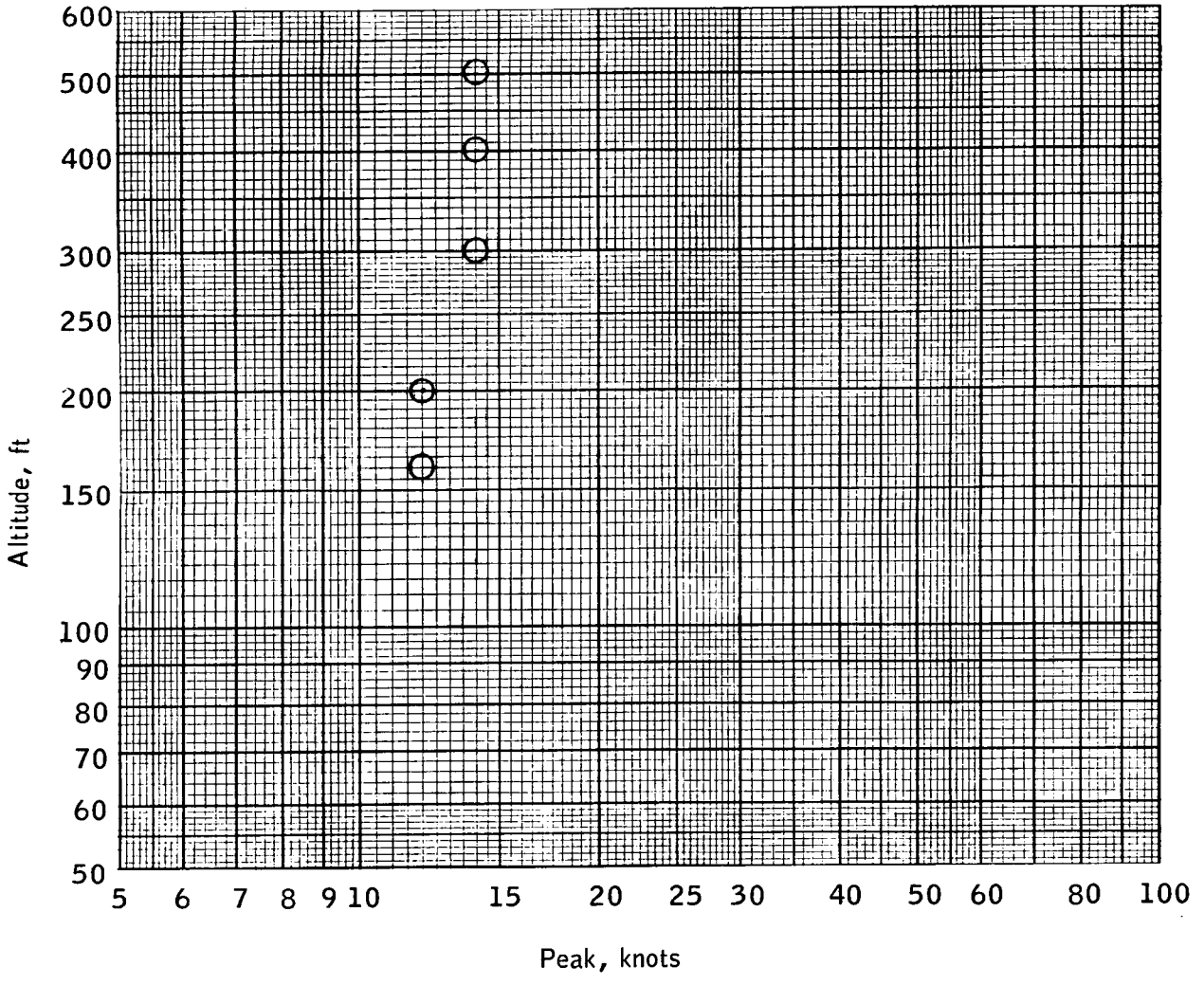
These data were plotted and are presented in figure 1. The peak wind velocity, the wind profile slope (P), and the predicted horizontal landing velocity for each time prior to lift-off is tabulated and presented in table I.

CONCLUDING REMARKS

All of the predicted horizontal velocities were below the spacecraft landing restriction of 54 fps. Because the maximum horizontal velocity calculated was 33 fps, the Apollo 9 launch was not delayed because of this restriction.

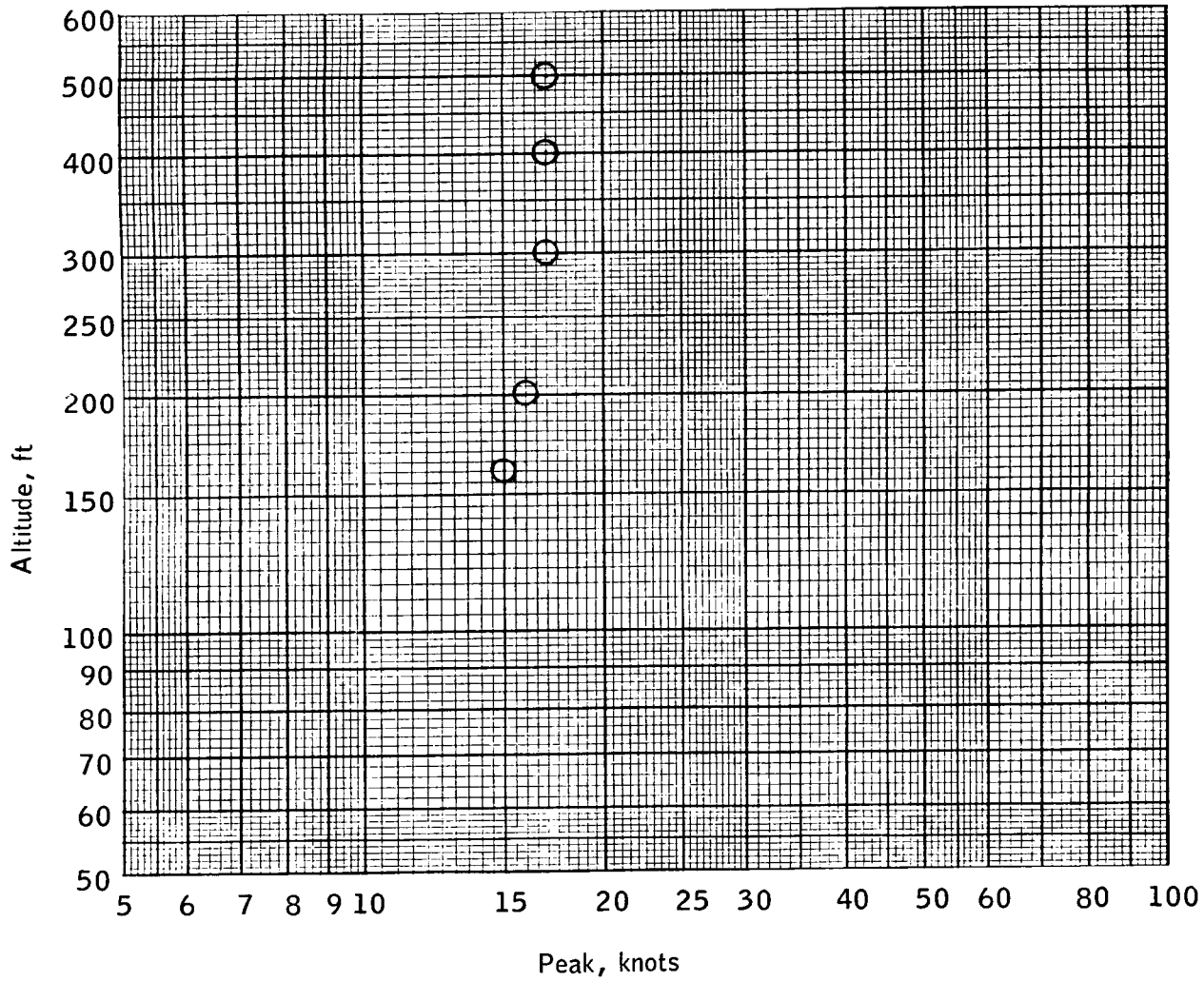
TABLE I.- APOLLO 9 MISSION PRELAUNCH WIND DATA

Time prior to lift-off, t minus hr	Peak velocity, knots					Wind profile slope, P	Predicted horizontal landing velocity, fps
	162-ft altitude	200-ft altitude	300-ft altitude	400-ft altitude	500-ft altitude		
t - 9.75	12	12	14	14	14	0.15	23
t - 7.50	15	16	17	17	17	.01	29
t - 4.25	15	16	18	17	16	0.	28
t - 1.75	10	10	13	12	15	.31	22
t - 0.75	17	10	19	20	21	.16	33



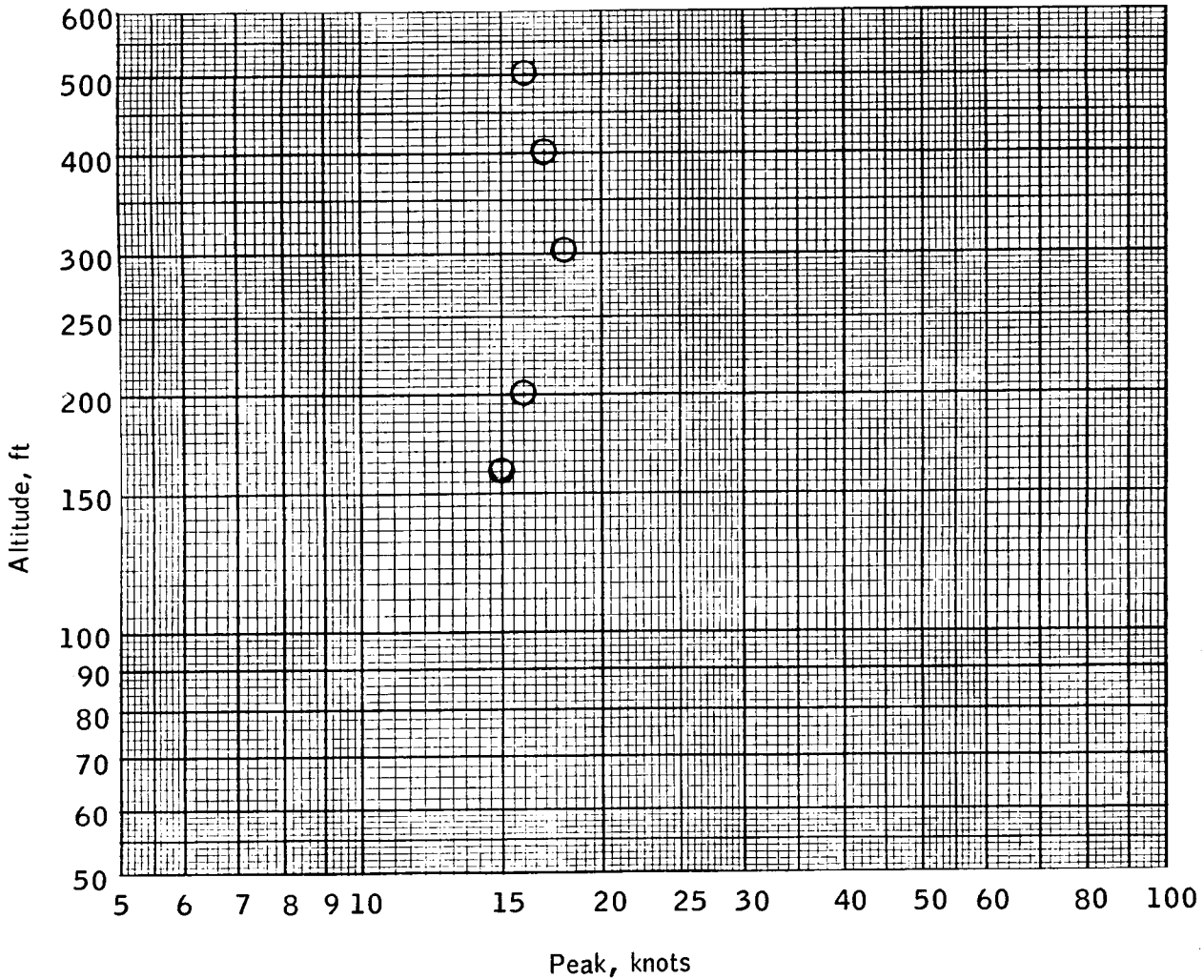
(a) t minus 9.75 hours.

Figure 1.- Altitude versus peak wind velocity.



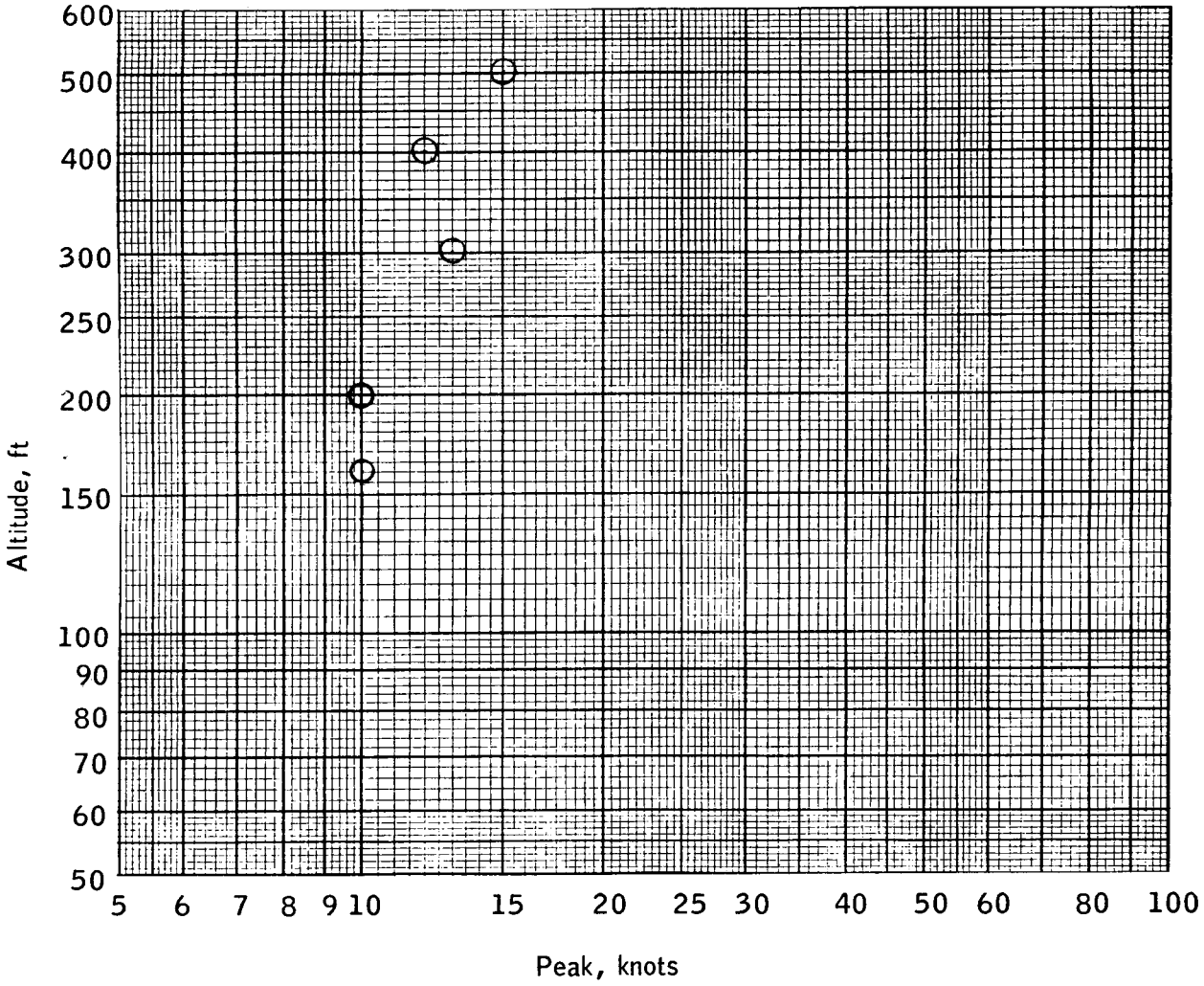
(b) t minus 7.5 hours.

Figure 1.- Continued.



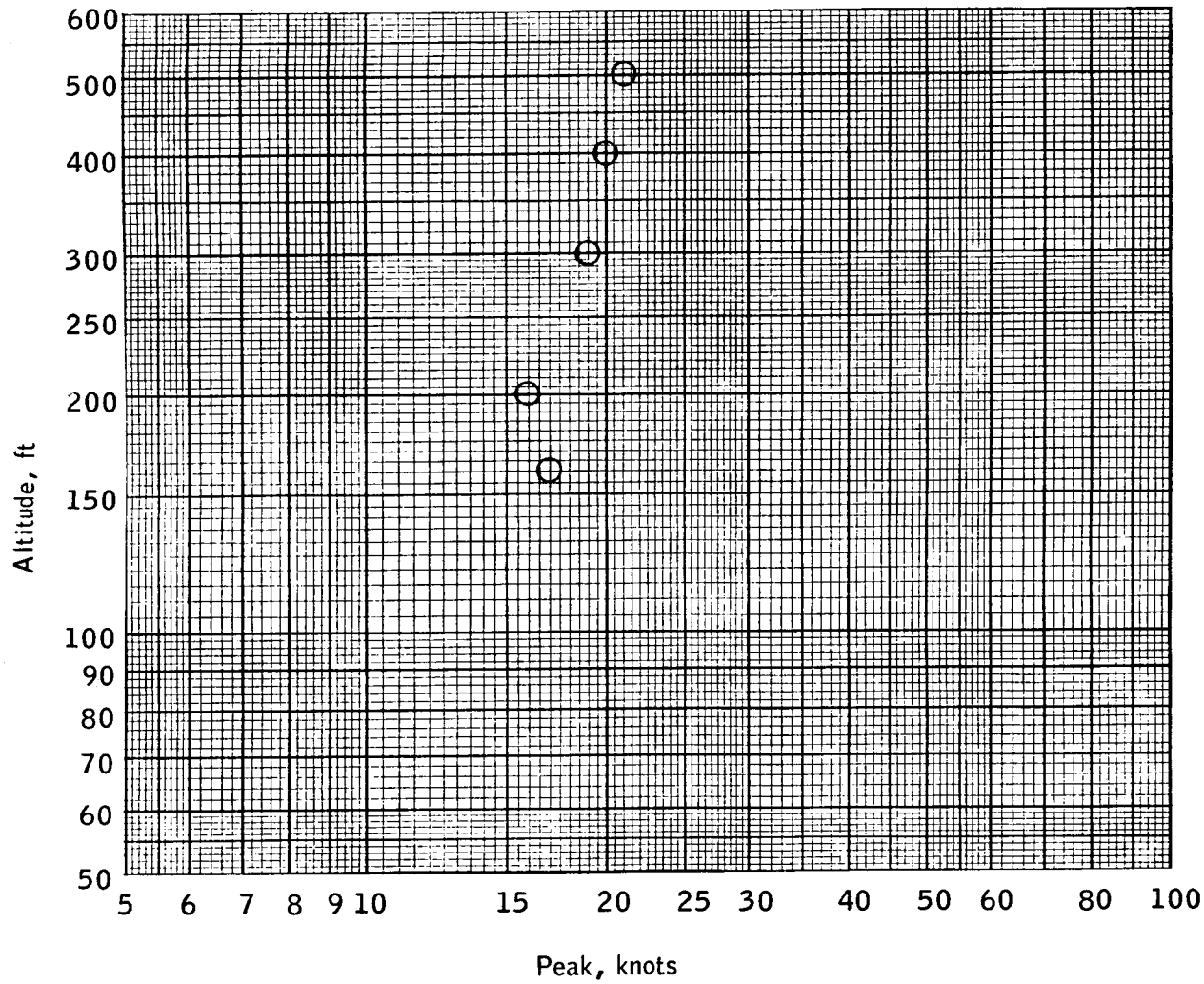
(c) t minus 4.25 hours.

Figure 1.- Continued.



(d) t minus 1.75 hours.

Figure 1.- Continued.



(e) t minus 0.75 hour.

Figure 1.- Concluded.

REFERENCE

1. Newman, Samuel R.; and Ives, Dallas G.: Predicted Horizontal Velocity for Spacecraft Land Landings Calculated During the Apollo 8 Countdown Demonstration Test. MSC IN 69-FM-2, January 7, 1969.